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EXAMINER	
LOVEL, KIMBERLY M	

ART UNIT	PAPER NUMBER
2167	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/799,427	DETLEFS ET AL.	
	Examiner	Art Unit	
	Kimberly Lovel	2167	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *3/12/2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/14/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-39 are rejected.

Double Patenting

2. A rejection based on double patenting of the "same invention" type finds its support in the language of 35 U.S.C. 101 which states that "whoever invents or discovers any new and useful process ... may obtain a patent therefor ..." (Emphasis added). Thus, the term "same invention," in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957); and *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the conflicting claims so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

3. Claims 1-39 provisionally rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 1-39 of copending Application No. 10/985787. This is a provisional double patenting rejection since the conflicting claims have not in fact been patented.

Information Disclosure Statement

4. The information disclosure statement (IDS) submitted on 14 July 2004 was filed after the mailing date of the application on 12 March 2004. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Claim Objections

5. Claims 1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 38 and 39 objected to because of the following informalities:

In claims 1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 38 and 39, the examiner assumes that there is a typographical error in limitation C). The examiner thinks that the claim should state "in at least one mode of operation, places dynamically allocated objects so that no candidate-set region contains an object whose age is less than a maximum age greater than one also contains any object of a different age."

Claims 7, 16, 25, 34 and 39 in limitation b) recite the phrase "sometimes includes." Applicant is advised that the use of the term "sometimes" in a claim nullifies the limitation. For example, when something sometimes happens it also sometimes does not happen. Therefore, prior art that does not contain the limitation, also reads on the limitation.

Appropriate correction is required.

Claim Rejections - 35 USC § 101

6. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

7. Claims 28-39 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Regarding claims 28-36, the claims are for an electromagnetic signal.

According to MPEP section 2106:

There is always some form of physical transformation within a computer because a computer acts on signals and transforms them during its operation and changes the state of its components during the execution of a process. Even though such a physical transformation occurs within a computer, such activity is not determinative of whether the process is statutory because such transformation alone does not distinguish a statutory computer process from a nonstatutory computer process. What is determinative is not how the computer performs the process, but what the computer does to achieve a practical application. See *Arrhythmia*, 958 F.2d at 1057, 22 USPQ2d at 1036.

Therefore, a signal is considered to represent non-statutory subject matter.

Regarding claims 37-39, the claims are directed towards a garbage collector. However, all of the elements claimed could be reasonably interpreted in light of the disclosure by an ordinary artisan as being software alone, and thus is directed to software per se, which is non-statutory.

According to MPEP section 2106:

Data structures not claimed as embodied in computer-readable media are descriptive material *per se* and are not statutory because they are not capable of causing functional change in the computer. See, e.g., *Warmerdam*, 33 F.3d at 1361, 31 USPQ2d at 1760 (claim to a data structure *per se* held nonstatutory). Such claimed data structures do not define any structural and functional interrelationships between the data structure and other claimed aspects of the invention which permit the data structure's functionality to be realized. In contrast, a claimed computer-readable medium encoded with a data structure defines structural and functional interrelationships between the data structure and the computer software and hardware components which permit the data structure's functionality to be realized, and is thus statutory.

Therefore, in order for such a software claim to be statutory, it must be claimed in combination with an appropriate medium and/or hardware to establish a statutory category of invention and enable any functionality to be realized.

To allow for compact prosecution, the examiner will apply prior art to these claims as best understood, with the assumption that applicant will amend to overcome the stated 101 rejections.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. Claims 7, 9, 16, 18, 25, 27, 34, 36 and 39 are rejected under 35 U.S.C. 102(e) as being anticipated by US PGPub 2004/0039759 to Detlefs et al (hereafter Detlefs et al).

10. The applied reference has a common inventor and assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Referring to claim 7, Detlefs et al disclose a computer system configured by machine instructions as a garbage collector that:

A) treats [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) collects in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented) chosen from among a candidate set of the regions in accordance with such a selection criterion that the resultant collection set sometimes includes a region whose age is less than that of a region in the candidate set omitted from the collection set and sometimes includes a region whose age is greater than that of a region that was in the candidate set but was omitted from the collection set [occurs in the semispaces when dealing with pinning objects] (see [0072] and [0075], lines 19-22); and

C) in at least one mode of operation, so places dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 9, Detlefs et al disclose a computer system as defined in claim 7 wherein the garbage collector assigns respective age values to the regions without recording ages separately for all dynamically allocated objects [recording age values for card tables] (see [0061] – [0063]), the age assigned each region into which the collector evacuates potentially reachable objects from a collection-set region assigned an age less than the maximum age being one greater than the age assigned to that collection-set region (see [0072] and [0077], lines 5-7 – when an object is moved

from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 16, Detlefs et al disclose for reclaiming dynamically allocated memory in a computer system, a method comprising employing the computer system to:

A) treat [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) collect in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented) chosen from among a candidate set of the regions in accordance with such a selection criterion that the resultant collection set sometimes includes a region whose age is less than that of a region in the candidate set omitted from the collection set and sometimes includes a region whose age is greater than that of a region that was in the candidate set but was omitted from the collection set [occurs in the semispaces when dealing with pinning objects] (see [0072] and [0075], lines 19-22); and

C) in at least one mode of operation, so place dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077],

lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 18, Detlefs et al disclose a method as defined in claim 16 wherein the garbage collector assigns respective age values to the regions without recording ages separately for all dynamically allocated objects [recording age values for card tables] (see [0061] – [0063]), the age assigned each region into which the collector evacuates potentially reachable objects from a collection-set region assigned an age less than the maximum age being one greater than the age assigned to that collection-set region (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 25, Detlefs et al disclose a storage medium containing computer instructions readable by a computer system to configure the computer system as a garbage collector that:

A) treats [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) collects in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented) chosen from among a candidate set of the regions in accordance with such a selection criterion that the resultant collection set sometimes includes a region whose age is less than that of a

region in the candidate set omitted from the collection set and sometimes includes a region whose age is greater than that of a region that was in the candidate set but was omitted from the collection set [occurs in the semispaces when dealing with pinning objects] (see [0072] and [0075], lines 19-22); and

C) in at least one mode of operation, so places dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 27, Detlefs et al disclose a storage medium as defined in claim 25 wherein the garbage collector assigns respective age values to the regions without recording ages separately for all dynamically allocated objects [recording age values for card tables] (see [0061] – [0063]), the age assigned each region into which the collector evacuates potentially reachable objects from a collection-set region assigned an age less than the maximum age being one greater than the age assigned to that collection-set region (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 34, Detlefs et al disclose an electromagnetic signal representing computer instructions readable by a computer system to configure the computer system as a garbage collector:

A) treats [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) collects in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented) chosen from among a candidate set of the regions in accordance with such a selection criterion that the resultant collection set sometimes includes a region whose age is less than that of a region in the candidate set omitted from the collection set and sometimes includes a region whose age is greater than that of a region that was in the candidate set but was omitted from the collection set [occurs in the semispaces when dealing with pinning objects] (see [0072] and [0075], lines 19-22); and

C) in at least one mode of operation, so places dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 36, Detlefs et al disclose an electromagnetic signal as defined in claim 34 wherein the garbage collector assigns respective age values to the regions without recording ages separately for all dynamically allocated objects [recording age values for card tables] (see [0061] – [0063]), the age assigned each

region into which the collector evacuates potentially reachable objects from a collection-set region assigned an age less than the maximum age being one greater than the age assigned to that collection-set region (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 39, Detlefs et al disclose a garbage collector comprising:

A) means for treating [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) means for collecting in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented) chosen from among a candidate set of the regions in accordance with such a selection criterion that the resultant collection set sometimes includes a region whose age is less than that of a region in the candidate set omitted from the collection set and sometimes includes a region whose age is greater than that of a region that was in the candidate set but was omitted from the collection set [occurs in the semispaces when dealing with pinning objects] (see [0072] and [0075], lines 19-22); and

C) means for, in at least one mode of operation, so placing dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see

[0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

12. Claims 1, 3, 4, 6, 10, 12, 13, 15, 19, 21, 22, 24, 28, 30, 31, 33, 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over US PGPub 2004/0039759 to Detlefs et al in view of the applicants' admitted prior art of US PGPub 2004/0039759 to Detlefs et al (hereafter Background '980).

Referring to claim 1, Detlefs et al disclose a computer system configured by machine instructions as a garbage collector that:

A) treats [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) collects in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented); and

C) in at least one mode of operation, so places dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

However, Detlefs et al fail to explicitly disclose the further limitation of B) wherein the collection sets are chosen in accordance with respective estimated collection efficiencies from among a candidate set of the regions. Background '980 discloses the operation of generational garbage collectors, including the further limitation of B) wherein the collection sets are chosen in accordance with respective estimated collection efficiencies from among a candidate set of the regions (see [0031], lines 3-12 and [0036], lines 5-7) in order to increase the efficiency of the application that employs the collector's services.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to select sets to be collected based on the criteria of efficiency as

disclosed by Background '980 as the criteria for the collecting sets disclosed by Detlefs et al. One would have been motivated to do so in order to increase the efficiency of the application that employs the collector's services (see Background '980: see [0031], lines 6-12).

Referring to claim 3, the combination of Detlefs et al and Background '980 (hereafter Detlefs/Background) discloses a computer system as defined in claim 1 wherein the garbage collector assigns respective age values to the regions without recording ages separately for all dynamically allocated objects [recording age values for card tables] (Detlefs et al: see [0061] – [0063]), the age assigned each region into which the collector evacuates potentially reachable objects from a collection-set region assigned an age less than the maximum age being one greater than the age assigned to that collection-set region (Detlefs et al: see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 4, Detlefs et al disclose a computer system configured by machine instructions as a garbage collector that:

A) treats [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) collects in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented); and

C) in at least one mode of operation, so places dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

However, Detlefs et al fail to explicitly disclose the further limitation of B) wherein the collection sets are chosen in accordance with a selection criteria separate from object age [efficiencies], from among a candidate set of the regions. Background '980 discloses the operation of generational garbage collectors, including the further limitation of B) wherein the collection sets are chosen in accordance with a selection criteria separate from object age [efficiencies], from among a candidate set of the regions (see [0031], lines 3-12 and [0036], lines 5-7) in order to increase the efficiency of the application that employs the collector's services.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to select sets to be collected based on the criteria of efficiency as disclosed by Background '980 as the criteria for the collecting sets disclosed by Detlefs et al. One would have been motivated to do so in order to increase the efficiency of the application that employs the collector's services (see Background '980: see [0031], lines 6-12).

Referring to claim 6, Detlefs/Background discloses a computer system as defined in claim 4 wherein the garbage collector assigns respective age values to the

regions without recording ages separately for all dynamically allocated objects [recording age values for card tables] (Detlefs et al: see [0061] – [0063]), the age assigned each region into which the collector evacuates potentially reachable objects from a collection-set region assigned an age less than the maximum age being one greater than the age assigned to that collection-set region (Detlefs et al: see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 10, Detlefs et al disclose for reclaiming dynamically allocated memory in a computer system, a method comprising employing the computer system to:

A) treat [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) collect in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented); and

C) in at least one mode of operation, so place dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

However, Detlefs et al fail to explicitly disclose the further limitation of B) wherein the collection sets are chosen in accordance with respective estimated collection efficiencies from among a candidate set of the regions. Background '980 discloses the operation of generational garbage collectors, including the further limitation of B) wherein the collection sets are chosen in accordance with respective estimated collection efficiencies from among a candidate set of the regions (see [0031], lines 3-12 and [0036], lines 5-7) in order to increase the efficiency of the application that employs the collector's services.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to select sets to be collected based on the criteria of efficiency as disclosed by Background '980 as the criteria for the collecting sets disclosed by Detlefs et al. One would have been motivated to do so in order to increase the efficiency of the application that employs the collector's services (see Background '980: see [0031], lines 6-12).

Referring to claim 12, Detlefs/Background discloses a method as defined in claim 10 wherein the garbage collector assigns respective age values to the regions without recording ages separately for all dynamically allocated objects [recording age values for card tables] (Detlefs et al: see [0061] – [0063]), the age assigned each region into which the collector evacuates potentially reachable objects from a collection-set region assigned an age less than the maximum age being one greater than the age assigned to that collection-set region (Detlefs et al: see [0072] and [0077], lines 5-7 –

when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 13, Detlefs et al disclose for reclaiming dynamically allocated memory in a computer system, a method comprising employing the computer system to:

A) treat [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) collect in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented); and

C) in at least one mode of operation, so place dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

However, Detlefs et al fail to explicitly disclose the further limitation of B) wherein the collection sets are chosen in accordance with a selection criteria separate from object age [efficiencies], from among a candidate set of the regions. Background '980 discloses the operation of generational garbage collectors, including the further limitation of B) wherein the collection sets are chosen in accordance with a selection

criteria separate from object age [efficiencies], from among a candidate set of the regions (see [0031], lines 3-12 and [0036], lines 5-7) in order to increase the efficiency of the application that employs the collector's services.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to select sets to be collected based on the criteria of efficiency as disclosed by Background '980 as the criteria for the collecting sets disclosed by Detlefs et al. One would have been motivated to do so in order to increase the efficiency of the application that employs the collector's services (see Background '980: see [0031], lines 6-12).

Referring to claim 15, Detlefs/Background discloses a method as defined in claim 13 wherein the garbage collector assigns respective age values to the regions without recording ages separately for all dynamically allocated objects [recording age values for card tables] (Detlefs et al: see [0061] – [0063]), the age assigned each region into which the collector evacuates potentially reachable objects from a collection-set region assigned an age less than the maximum age being one greater than the age assigned to that collection-set region (Detlefs et al: see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 19, Detlefs et al disclose a storage medium containing computer instructions readable by a computer system to configure the computer system as a garbage collector:

A) treats [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) collects in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented); and

C) in at least one mode of operation, so places dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

However, Detlefs et al fail to explicitly disclose the further limitation of B) wherein the collection sets are chosen in accordance with respective estimated collection efficiencies from among a candidate set of the regions. Background '980 discloses the operation of generational garbage collectors, including the further limitation of B) wherein the collection sets are chosen in accordance with respective estimated collection efficiencies from among a candidate set of the regions (see [0031], lines 3-12 and [0036], lines 5-7) in order to increase the efficiency of the application that employs the collector's services.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to select sets to be collected based on the criteria of efficiency as

disclosed by Background '980 as the criteria for the collecting sets disclosed by Detlefs et al. One would have been motivated to do so in order to increase the efficiency of the application that employs the collector's services (see Background '980: see [0031], lines 6-12).

Referring to claim 21, Detlefs/Background discloses a storage medium as defined in claim 19 wherein the garbage collector assigns respective age values to the regions without recording ages separately for all dynamically allocated objects [recording age values for card tables] (Detlefs et al: see [0061] – [0063]), the age assigned each region into which the collector evacuates potentially reachable objects from a collection-set region assigned an age less than the maximum age being one greater than the age assigned to that collection-set region (Detlefs et al: see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 22, Detlefs et al disclose a storage medium containing computer instructions readable by a computer system to configure the computer system as a garbage collector that:

A) treats [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) collects in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented); and

C) in at least one mode of operation, so places dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

However, Detlefs et al fail to explicitly disclose the further limitation of B) wherein the collection sets are chosen in accordance with a selection criteria separate from object age [efficiencies], from among a candidate set of the regions. Background '980 discloses the operation of generational garbage collectors, including the further limitation of B) wherein the collection sets are chosen in accordance with a selection criteria separate from object age [efficiencies], from among a candidate set of the regions (see [0031], lines 3-12 and [0036], lines 5-7) in order to increase the efficiency of the application that employs the collector's services.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to select sets to be collected based on the criteria of efficiency as disclosed by Background '980 as the criteria for the collecting sets disclosed by Detlefs et al. One would have been motivated to do so in order to increase the efficiency of the application that employs the collector's services (see Background '980: see [0031], lines 6-12).

Referring to claim 24, Detlefs/Background discloses a storage medium as defined in claim 22 wherein the garbage collector assigns respective age values to the

regions without recording ages separately for all dynamically allocated objects [recording age values for card tables] (Detlefs et al: see [0061] – [0063]), the age assigned each region into which the collector evacuates potentially reachable objects from a collection-set region assigned an age less than the maximum age being one greater than the age assigned to that collection-set region (Detlefs et al: see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 28, Detlefs et al disclose an electromagnetic signal representing computer instructions readable by a computer system to configure the computer system as a garbage collector that:

A) treats [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) collects in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented); and

C) in at least one mode of operation, so places dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

However, Detlefs et al fail to explicitly disclose the further limitation of B) wherein the collection sets are chosen in accordance with respective estimated collection efficiencies from among a candidate set of the regions. Background '980 discloses the operation of generational garbage collectors, including the further limitation of B) wherein the collection sets are chosen in accordance with respective estimated collection efficiencies from among a candidate set of the regions (see [0031], lines 3-12 and [0036], lines 5-7) in order to increase the efficiency of the application that employs the collector's services.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to select sets to be collected based on the criteria of efficiency as disclosed by Background '980 as the criteria for the collecting sets disclosed by Detlefs et al. One would have been motivated to do so in order to increase the efficiency of the application that employs the collector's services (see Background '980: see [0031], lines 6-12).

Referring to claim 30, Detlefs/Background discloses an electromagnetic signal as defined in claim 28 wherein the garbage collector assigns respective age values to the regions without recording ages separately for all dynamically allocated objects [recording age values for card tables] (Detlefs et al: see [0061] – [0063]), the age assigned each region into which the collector evacuates potentially reachable objects from a collection-set region assigned an age less than the maximum age being one greater than the age assigned to that collection-set region (Detlefs et al: see [0072] and

[0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 31, Detlefs et al disclose an electromagnetic signal representing computer instructions readable by a computer system to configure the computer system as a garbage collector that:

A) treats [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) collects in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented); and

C) in at least one mode of operation, so places dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

However, Detlefs et al fail to explicitly disclose the further limitation of B) wherein the collection sets are chosen in accordance with a selection criteria separate from object age [efficiencies], from among a candidate set of the regions. Background '980 discloses the operation of generational garbage collectors, including the further limitation of B) wherein the collection sets are chosen in accordance with a selection

criteria separate from object age [efficiencies], from among a candidate set of the regions (see [0031], lines 3-12 and [0036], lines 5-7) in order to increase the efficiency of the application that employs the collector's services.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to select sets to be collected based on the criteria of efficiency as disclosed by Background '980 as the criteria for the collecting sets disclosed by Detlefs et al. One would have been motivated to do so in order to increase the efficiency of the application that employs the collector's services (see Background '980: see [0031], lines 6-12).

Referring to claim 33, Detlefs/Background discloses an electromagnetic signal as defined in claim 31 wherein the garbage collector assigns respective age values to the regions without recording ages separately for all dynamically allocated objects [recording age values for card tables] (Detlefs et al: see [0061] – [0063]), the age assigned each region into which the collector evacuates potentially reachable objects from a collection-set region assigned an age less than the maximum age being one greater than the age assigned to that collection-set region (Detlefs et al: see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

Referring to claim 37, Detlefs et al disclose a garbage collector:

A) means for treating [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically

allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) means for collecting in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented); and

C) means for, in at least one mode of operation, so places dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

However, Detlefs et al fail to explicitly disclose the further limitation of B) wherein the collection sets are chosen in accordance with respective estimated collection efficiencies from among a candidate set of the regions. Background '980 discloses the operation of generational garbage collectors, including the further limitation of B) wherein the collection sets are chosen in accordance with respective estimated collection efficiencies from among a candidate set of the regions (see [0031], lines 3-12 and [0036], lines 5-7) in order to increase the efficiency of the application that employs the collector's services.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to select sets to be collected based on the criteria of efficiency as disclosed by Background '980 as the criteria for the collecting sets disclosed by Detlefs

et al. One would have been motivated to do so in order to increase the efficiency of the application that employs the collector's services (see Background '980: see [0031], lines 6-12).

Referring to claim 38, Detlefs et al disclose a garbage collector comprising:

A) means for treating [the garbage collector searches the heap] at least a generation of a heap [heap 10] (see [0053], lines 1-3) in which objects are dynamically allocated (see [0052], lines 1-2) as divided into regions [young generation 50 and old generation 52] (see [0053], lines 2-4);

B) means for collecting in respective collection increments collection sets [collection cycle] (see [0072] – each time the cycle occurs, the objects are incremented); and

C) means for, in at least one mode of operation, so places dynamically allocated objects that no candidate-set region that contains an object whose age is less than a maximum age [predetermined age] greater than one also contains any object of a different age [each semispace is considered to contain objects of the same age] (see [0072] and [0077], lines 5-7 – when an object is moved from one semispace to the other, the age is incremented; when the object survives, it's value is marked as 1).

However, Detlefs et al fail to explicitly disclose the further limitation of B) wherein the collection sets are chosen in accordance with a selection criteria separate from object age [efficiencies], from among a candidate set of the regions. Background '980 discloses the operation of generational garbage collectors, including the further limitation of B) wherein the collection sets are chosen in accordance with a selection

criteria separate from object age [efficiencies], from among a candidate set of the regions (see [0031], lines 3-12 and [0036], lines 5-7) in order to increase the efficiency of the application that employs the collector's services.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to select sets to be collected based on the criteria of efficiency as disclosed by Background '980 as the criteria for the collecting sets disclosed by Detlefs et al. One would have been motivated to do so in order to increase the efficiency of the application that employs the collector's services (see Background '980: see [0031], lines 6-12).

13. Claims 2, 5, 11, 14, 20, 23, 29 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over as being unpatentable over US PGPub 2004/0039759 to Detlefs et al in view of the applicants' admitted prior art of US PGPub 2004/0039759 to Detlefs et al as applied respectively to claims 1, 4, 10, 13, 19, 22, 28 and 31 above, and further in view of US Patent No 6,526,422 to Flood et al (hereafter Flood et al).

Referring to claim 2, Detlefs/Background discloses a maximum age. However, Detlefs/Background fails to explicitly disclose the further limitation wherein the maximum age is two. Flood et al disclose a garbage collector (see abstract), including the further limitation wherein the maximum age is two (see column 9, lines 26-50 – popping an entry at age 2 is considered to represent a maximum age of 2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the maximum age of 2 as disclosed by Flood et al as the

maximum age of Detlefs/Background. One would have been motivated to do so in order to decrease the number of objects that have not been reallocated.

Referring to claim 5, the claim is rejected on the same grounds as claim 2.

Referring to claim 11, the claim is rejected on the same grounds as claim 2.

Referring to claim 14, the claim is rejected on the same grounds as claim 2.

Referring to claim 20, the claim is rejected on the same grounds as claim 2.

Referring to claim 23, the claim is rejected on the same grounds as claim 2.

Referring to claim 29, the claim is rejected on the same grounds as claim 2.

Referring to claim 32, the claim is rejected on the same grounds as claim 2.

14. Claims 8, 17, 26 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over as being unpatentable over US PGPub 2004/0039759 to Detlefs et al as applied respectively to claims 7, 16, 25 and 34 above, and further in view of US Patent No 6,526,422 to Flood et al (hereafter Flood et al).

Referring to claim 8, Detlefs/Background discloses a maximum age. However, Detlefs/Background fails to explicitly disclose the further limitation wherein the maximum age is two. Flood et al disclose a garbage collector (see abstract), including the further limitation wherein the maximum age is two (see column 9, lines 26-50 – popping an entry at age 2 is considered to represent a maximum age of 2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the maximum age of 2 as disclosed by Flood et al as the

maximum age of Detlefs/Background. One would have been motivated to do so in order to decrease the number of objects that have not been reallocated.

15.

Referring to claim 17, the claim is rejected on the same grounds as claim 2.

Referring to claim 26, the claim is rejected on the same grounds as claim 2.

Referring to claim 35, the claim is rejected on the same grounds as claim 2.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kimberly Lovel whose telephone number is (571) 272-2750. The examiner can normally be reached on 8:00 - 4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Cottingham can be reached on (571) 272-7079. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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17 September 2006
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